Situation alignment and routinization in language acquisition

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Abstract: Pickering & Garrod (P&G) describe a mechanism by which the situation models of dialog participants become progressively aligned via priming at different levels. This commentary attempts to characterize how alignment and routinization can be extended into the language acquisition domain by establishing links between alignment and joint attention, and between routinization and grammatical construction learning.

Pickering & Garrod (P&G) describe a mechanism by which the situation models of dialogue participants become progressively aligned via priming at different levels, including lexical, syntactic, semantic, and situational representations. An essential interest and novelty of this approach is that, instead of requiring a complex and effortful mechanism for explicitly constructing a common ground, it offers a rather straightforward mechanism that operates largely automatically via priming.

It is of potential interest that this type of alignment can be seen to be useful in other communicative contexts besides dialogue. Two such contexts can be considered, both of which extend the situation alignment mechanism into the domain of language acquisition. The first concerns the alignment of situation models in which one of the interlocutors is in a prelingual, acquisition phase. This emphasizes the suggestion that alignment can take place via nonverbal influences. Second, in the current formulation, the process of alignment and the formation of routines takes place on the time scale of single dialogues; however, these mechanisms can also be considered to span time frames that greatly exceed a single dialogue, particularly in the case of familiar repeated situations (feeding, bathing, playing), yielding "virtual dialogues" that can span a time period of several months. In such a situation, we can consider the formation of routines in the context of language acquisition to be analogous to the development of grammatical constructions.

Language acquisition can be functionally defined as the process of establishing the relation between sentences/discourses and their meanings. A significant part of this problem concerns the issue that before these relations can be established, the speaker and listener should be aligned with respect to the target meaning. If the meaning for the target utterance is not established both for the speaker and the listener, then construction of the mapping from utterance to meaning is indeterminate. This suggests the required existence of extra- or prelinguistic alignment mechanisms. Interestingly, there is indeed a significant body of research indicating that by six months of age, human infants achieve prelinguistic situation alignment by exploiting joint attention cues (e.g., gaze direction, postural orientation) in order to identify intended referents (e.g., Morales et al. 2000; Tomasello 2003). This indicates that P&G's Figure 2 could be modified to include nonlinguistic inputs at the semantic and situation model levels. Such a modification will allow both the "alignment bootstrapping" in which initial situation model alignment will play a crucial role in language acquisition as well as the influence of extralinguistic inputs in adult alignment contexts.

In a related extension of the alignment model into the acquisition domain, we can consider the relation between the development of production and comprehension routines in the time frame of a single dialogue and the development of grammatical constructions in the time frame of the first years of language acquisition. As specified by P&G, the creation of routines requires a coherent context in which the routines are applicable, and so, stretching this time frame to the scale of months and years is a non-negligible issue. Interestingly, Tomasello (2003) notes that repetitive events such as feeding, bathing, playing, and so on are relatively similar from episode to episode, and thus provide appropriate contexts that coherently span significant time periods. Given a temporally extended "virtual dialogue" domain, we can consider the development of routines as facilitatory not only within the context of a single dialogue but also in the more fundamental role of the development of communicative conventions that span significant time periods, thus forming the basis for language acquisition. In this context, routines take on the alternative identity of grammatical constructions (see Goldberg 1995), with all of their processing advantages. In particular, as described by P&G, the use of routines significantly eliminates the need for syntactic derivation of the appropriate grammatical structural forms, both for production and comprehension. When this approach is applied at the acquisition time scale, it is remarkably similar to the usage-based developmental approach to language acquisition advocated by Tomasello (2003).

In this framework, relatively fixed grammatical forms are linked to their corresponding meanings in the context of repetitive events (e.g., feeding, playing, etc.). These constructions/routines are then progressively opened to allow generalization within a given construction (e.g., variable replacement) to form new instances, and subsequent generalization to new constructions. Again, in both P&G's dialogue context and Tomasello's development context, highly functional communicative form-meaning constructions/routines are developed without reliance on a heavy initial investment in generative syntactic capabilities.

I have recently performed a series of simulation (Dominey 2000) and robotic (Dominey 2003a; 2003b) experiments to determine the feasibility of this type of approach to language acquisition in a restricted context. The underlying assumptions in the model are (1) that grammatical constructions correspond to the learned mapping between a given sentence type and its corresponding meaning frame (see Goldberg 1995), and (2) that grammatical constructions are uniquely identified by a limited set of cues that include word order and grammatical morphology including free and bound morphemes (Bates & MacWhinney 1987).

The model is provided with ⟨sentence, meaning⟩ pairs as input and should learn the Word-to-Referent and Sentence-to-Meaning mappings. For the current discussion, we assume that a limited set of concrete, open-class elements have been learned and will consider how this knowledge allows the learning of simple grammatical constructions. When a (sentence, meaning) pair is presented, the configuration of closed-class (function) elements is extracted and used as an index to "look up" the corresponding construction (routine) in the construction inventory. The construction corresponds to the learned mapping of open-class element positions in the sentence onto their thematic and event roles in the meaning representation. If there is no entry in the construction inventory (i.e., the current sentence type has never been previously encountered), then the construction is built on the fly by matching the referents for the open-class words with their respective roles in the meaning representation. The construction is then stored for future use. The developmental aspects of this learning are presented in more detail in Dominey (2000).

Thus, similar to P&G's routines, constructions are built by pairing the grammatical form with the aligned meaning (situation) representation. The interesting suggestion is that, at least to a certain degree, P&G's proposed situation alignment and routine construction capabilities provide a mechanism for language acquisition (at least the learning of fixed grammatical constructions that can generalize to new instances of the same constructions) which avoids the enlistment of generative grammar mechanisms. If a situation alignment priming mechanism could be demonstrated to perform in both the dialogue and acquisition time scales, this would be evidence for an ingenious economy of functional mechanisms for language processing in the context of dialogue.

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